

Space News Roundup

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National Aeronautics and Space Administration

News Briefs

Alumni league formed

The NASA Alumni League was formed August 1 to support the goals and activities of NASA as outlined in the National Space Act of 1958. Membership is open to anyone who has ever been a NASA employee. This nationwide organization has former JSC Director Gerald Griffin as president. Revenues to support league activities will come from annual dues, which are tax deductible. Membership categories are: individual, \$30; supporting, \$100; sustaining, \$250; life, \$500; benefactor and life, \$1,000. Eligible persons interested in joining the league should write NASA Alumni League, 600 Maryland Ave., SW, West Wing Suite 203, Washington, D.C. 20024.

ET's use investigated

Marshall Space Flight Center has awarded a contract to Martin Marietta Michoud Aerospace to study the feasibility of outfitting a Space Shuttle external tank as a space-based gamma ray imaging telescope. Once in space, residual propellants could be expelled from the tank. Astronauts could then assemble telescope components within the aft section, a 96.7 foot-long liquid hydrogen tank. Astronauts could reach the inside of the tank via an existing 36-inch aft manhole port or through a future modification of the tank. Previous studies have looked at the possibility of carrying the 154 foot-long, 27.6 foot-diameter tank into orbit for many uses including modules for an as yet unplanned space station. Dr. David Koch of the Smithsonian Institution Astrophysical Observatory in Cambridge, Mass., developed the concept of the gamma ray telescope using the external tank. Koch said that processes that can be uniquely examined using gamma rays include nuclear interactions of energetic nuclei, electromagnetic processes and matter-antimatter annihilation. Koch anticipates that after five years, enough data will be gathered to determine the sources of gamma rays from the universe. The proposed telescope would require periodic maintenance, and would therefore probably orbit near the Space Station.

JSC lets media contract

JSC has selected Media Services Corp. of Houston for negotiations leading to a cost-plus-fixed-fee contract for public information and media support services. The contract covers public affairs planning for television of Space Shuttle flights, operation of still photo, film and video distribution libraries, new media support and other services. The estimated value of the first year of the contract is \$1.3 million. NASA will have the option to extend the contract on an annual basis for up to five years.

Stellacom wins TV contract

JSC has awarded a cost-plus-award-fee contract to Stellacom, Inc. of Houston for center television support services. Valued at \$4.03 million for the contract year starting Sept. 1, the contract covers management, engineering, operation and maintenance of JSC's TV systems and equipment. If exercised, options will increase contract value by \$4.64 million for the first option, and \$5.11 million for the second. The contract provides for two one-year options.

Developer selected

NASA August 13 announced the Pratt & Whitney Aircraft was selected for negotiations leading to a contract for the development of alternate high-pressure fuel and oxidizer turbopumps. The turbopumps are intended to be interchangeable with the current Shuttle main engine turbopumps, and provide extended life and improve safety margins.

4th Orbiter OK'd

President charts new commercial policy

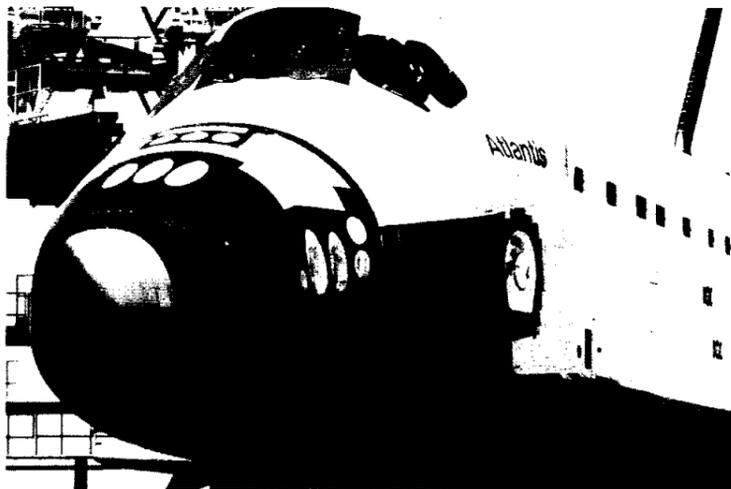
President Reagan's authorization for construction of an Orbiter to replace the *Challenger* calls for the new vehicle to join the fleet in 1991.

The two-step space policy announced August 15 also calls for NASA to discontinue launching commercial satellites, albeit with certain exceptions to be made where necessary. The policy would generally limit NASA to launching research and development, scientific and national security payloads aboard the Shuttle. Through this new policy, the Government hopes to encourage development of a private sector launch industry using expendable boosters.

A statement issued by the White House said the decision to build another Orbiter "will bring our Shuttle fleet up to strength and enable the United States to safely and energetically project a manned presence in space."

"Morale is up 1,000 percent," NASA Administrator James C. Fletcher said. "NASA is pleased with the President's decision to replace *Challenger*. Coupled with his strong commitment to the Space Station, encouragement of a private launch industry and the prospect of a mixed fleet, this decision demonstrates his determination that the United States maintain world leadership in space."

Under the President's plan, NASA would be given budget authority for \$272 million in Fiscal Year 1987, Fletcher said. NASA had requested \$250 million to go for a new Orbiter and another \$36 million to replace the Inertial Upper Stage cradle lost in the 51-L accident, he said. This means NASA would have to come up with about \$14 million from the present budget to meet a goal of \$286 million for Orbiter construction and replacement of the cradle in FY '87, Fletcher said.



"This is a budget amendment, and has to be approved by both houses of Congress," he added. Fletcher said the commitment for the new Orbiter is for FY '87 only, although outlays for the years

beyond '87 were indicated, "We will have to examine year by year how much will come out of NASA's budget and how much from the rest of government," he added.

(Continued on page 2)

OV 105 to incorporate latest advances

Orbiter Vehicle 105 will incorporate many of the improved systems now in work in the Shuttle Program, according to Orbiter Projects Office Manager Richard A. Colonna.

"It will be built essentially to the OV 104 (*Atlantis*) drawings," Colonna said. He said the Orbiter would incorporate improvements in auxiliary power units, inertial measurement units, fuel cells, general purpose computers, the new carbon-carbon brake system, the improved waste containment system and the fully redundant nose-wheel steering, all of which also are planned for the rest of the Orbiter fleet.

In addition, the new Orbiter would incorporate any crew escape systems which might be implemented, and would have the new 17-inch Orbiter/External Tank pro-

pellant line disconnect redesign if that plan is approved within the National Space Transportation System Program.

Crew escape options are receiving "very detailed attention," NASA Administrator James C. Fletcher said, but the "exceedingly complicated" review has not yet been completed. The 17-inch disconnect is one of the critical elements which has come under review since the 51-L accident.

Colonna said the amount of money authorized for outlay in Fiscal Year 1987 (about \$250 million) will allow NASA to bring the component suppliers on line—more than 110 companies who supply parts for the Shuttle. "It will enable us to order equipment as needed and begin hiring at Rockwell's Palmdale and Downey,

California plants," Colonna said.

Much of the primary structure necessary for another Orbiter is already on hand, Colonna said. Primary structure includes the wings, tail, and crew module, fuselage and other major structural components. Most of the work to be done, he said, will be to build secondary structure and equipment installation structure—such as struts, clamps and harnesses.

"Secondary structure is that which is not necessary for carrying the overall loads the spacecraft must absorb," Colonna said, "but which is needed for instance, to attach an APU, or to attach the cryo tanks."

Also needed will be system interconnecting hardware, such as fluid lines, miles of wiring, and thousands of heat protecting tiles.

Colonna said Rockwell could progress well into 1988 before large numbers of people would have to be hired. "They would have a need for higher numbers of workers toward the latter half of the building program," he said.

JSC would expect to assign five or six engineers to the existing STS Orbiter and GFE (Government Furnished Equipment) Projects Office to help oversee the new work, Colonna said.

A name for the new Orbiter has not yet been chosen. Some have suggested calling it *Challenger II*. Fletcher said in his news conference August 18 that he can see naming the ship *Challenger II* in memory of the 51-L crewmembers, but that there are many other ideas as well, and that a final decision has not yet been made.

Hauck moves to HQ

Astronaut Frederick (Rick) Hauck has assumed his new duties as the Deputy Associate Administrator for External Relations at NASA Headquarters.

In this position, Hauck will share responsibility for policy level management, direction and coordination of the agency's relationships with public and private organizations both domestic and international. This includes the news media, other federal agencies, state and local governments, foreign governments, international agencies, industry and private individuals.

A Navy captain, Hauck was selected as an astronaut candidate by NASA in January 1978. He was commander of STS-51A and pilot for STS-7. He also was a member of the support crew for STS-1 and re-entry capsule communicator on the support crew for STS-2.

Born April 11, 1941, in Long Beach, Calif., Hauck received a bachelor of science degree in physics from Tufts University in

1962 and a master of science degree in nuclear engineering from the Massachusetts Institute of Technology in 1966.

A Navy ROTC student at Tufts, he served 20 months as communications officer and combat information center officer aboard the destroyer USS Warrington. After receiving his wings in 1968 from the Naval Air Station in Pensacola, Fla., he flew 114 combat and support missions in Southeast Asia while stationed aboard the carrier USS Coral Sea. In 1970, Hauck was selected for test pilot training at the U.S. Naval Test Pilot School, Patuxent River, Md.

Hauck has flown various aircraft including the A-6, A-7 and F-14. He has been awarded 9 Air Medals, the Navy Commendation Medal with Gold Star and Combat V and the NASA Space Flight Medal. He also was named Outstanding Test Pilot for 1972.

Captain Hauck is married and has two children.



Center Director Jesse Moore presented a trophy to four members of a relay team that represented JSC in a June 17 race at San Jacinto battlegrounds. The team, composed of Air Force 1st Lt. Sammy Payne, Capt. Debbie Zelenak and JSC employees Patty Herrick and Kent Joosten, finished second and managed to beat the previous course record by five minutes. The team ran in a 4 x 2 relay, four people each running two miles, at the Diamond Shamrock Corporate Relays. Moore presented the trophy to the team July 31.

Three secretaries have recently been awarded the Marilyn Bocking Secretarial Excellence Award — and the \$500 that comes with it — for their outstanding service to NASA.

"Lori Beauregard exhibits all the qualities of a professional secretary. She is dedicated to her job, takes pride in her work, shows a strong degree of self-motivation and works well with others," said Advanced Programs Office manager Robert Ried in explaining her award for May, 1986.



Lori Beauregard

Ried said during the recent reorganization she was assigned to provide additional assistance to the Missions and Projects Office. Her duties were also increased when the Advanced Programs Office's senior secretary was on an extended absence. "Due to the lack of secretarial support, she had to assume the respon-

sibilities of the Advanced Programs Office while not neglecting her own office personnel," Ried said. Her pride, dedication and motivation are shown by the work she does. "She does not have to be asked to assume a task, she sees a need and responds. She frequently

arrives early and stays late to accommodate office needs, and she has enabled the office to meet critical deadlines. Her current workload does not detract from her high standards either," Ried said.

Beauregard also often works weekends to assist the Computational Support Office. "She has the responsibility to maintain backup files of the systems software. She possesses the special skills required to link the corporate computers with outside computer services and can readily transfer files from one system to the other," Ried said.

Carol Irby, who has served at the White Sands Test Facility (WSTF) for over 23 years, was the winner of the Bocking Award for June. "Since the small size of the NASA contingent at WSTF precludes the depth of specialized support services available at larger installations, the secretary to the



Mary Chesler

WSTF manager has developed a high degree of independence and versatility to perform most of these diverse functions herself," said Rob Tillett, manager of WSTF.

"The non-stereotyped nature of test work has created an unusual number of unique, unforeseen demands, and as the primary focal point for many of these demands, she has demonstrated exceptional innovation, adaptability, poise and judgment in handling these one-time-only requests, as well as the heavy load of daily routine functions," Tillett said.

Tillett also said that in addition to the routine functions performed by an executive secretary, she serves as the public affairs, personnel, awards and training co-

People

ordinator for WSTF. "These varied responsibilities put her in constant contact with representatives from the general public, the media and academic/industrial sectors, as well as with JSC and Headquarters management, Tillett said.

The Bocking award winner for July was Mary Chesler, secretary to the manager, STS Orbiter and GFE Projects Office. Richard Colonna, manager of the office, said Chesler was promoted to her present position during a recent reorganization. "During this transition period she ensured the continuing smooth and efficient operation of the office and has established a good rapport with the peers, the managers and visitors," Colonna said.

"I depend on her to manage the day-to-day activities and keep the office running smoothly at all times. I also rely on her to schedule my calendar, which requires many changes daily to ensure that important items are handled in a timely manner. She has approached the heavy workload of this office with enthusiasm, good humor and her usual efficient manner," Colonna said.

He added Chesler was his secretary when he was in the Shuttle Projects Office. "She was very active in the administrative support to the Mission Evaluation Room. She did an outstanding job of assembling the mission teams and scheduling all administrative support to the MER. This involved coordinating secretarial support from other directorates to cover three shifts, usually involving last minute changes. She handled these responsibilities in an exceptional manner, and was always willing to help whenever and wherever needed," Colonna said.

William H. Dana has been appointed Chief Pilot at NASA's Ames-Dryden Flight Research Facility. He replaces Fitzhugh L.



Joseph Goldberg makes his end-of-summer report on the work he did this summer while visiting JSC as a faculty fellow. Goldberg was one of 31 university professors in the NASA/American Society of Engineering Educators Summer Faculty Program who worked for 10 weeks this summer at JSC.

Fulton, who recently retired. Dana has been with NASA since 1958 as an aerospace research pilot. He flew the famed X-15 rocket-powered research aircraft 16 times, reaching a top speed of 3,897 mph and a peak altitude of 310,000 feet. His current piloting assignment is as project pilot on the F-15 Highly Integrated Digital Electronic Control program. He also flew the triple-sonic YF-12.

Dr. Sally K. Ride has been detailed to the position of Special Assistant to the Administrator for Strategic Planning. In this position, she will be responsible for review-

ing NASA's goals and objectives for near to long-term planning. Ride was selected by NASA as an astronaut candidate in 1978. She has been a mission specialist on two Space Shuttle flights — STS-7 in June 1983 and STS 41-G in October 1984. Recently she served as a member of the Presidential Commission on the Space Shuttle Challenger Accident. A native of Los Angeles, Ride is a graduate of Stanford University, where she received a B.S. degree in physics and a B.A. degree in English in 1973, and M.S. and Ph.D. degrees in physics in 1975 and 1978, respectively.



Wayne Reed receives a \$500 scholarship from Denice Landry of the Federal Employees Association. Reed is the son of Ethel Reed, a JSC employee who works in the Printing Management Division. Wayne will attend the University of Houston to study architecture.



Carol Irby

sibilities of the Advanced Programs Office while not neglecting her own office personnel," Ried said.

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Bulletin Board

Alley Theater tickets offered

The Alley Theater corporate "Dinner & the Theater" subscription is again being offered to NASA and contractor employees. Ten open passes and 20 2-for-1 dinner certificates will be available for \$99.00 which may be charged on a variety of credit cards. Employee Activities Association representatives, bulletin boards and cafeterias have flyers with order forms that explain the program. Subscribers should send filled-out forms to Doris Wood, FD 4, before Sept. 19 or directly to the Alley. Call Wood at x5263 for more information.

NARFE dinner meeting set

"The people's lawyer," Richard Alderman, is the featured speaker at the NASA area chapter of the National Association of Retired Federal Employees. Alderman will speak at a dinner meeting at 6 p.m. Sept. 2 at the Harris County Park Building, 5001 NASA Rd. 1. All retirees and those planning retirement are invited. For further information, call Dick Jacobs at 532-1075 or Burney Goodwin at 326-2494.

Adult officers sought

The newly formed Junior Astronaut Corps is seeking a few adult officers to assist in the formation of the local Space Port Houston chapter of the corps. The chapter is located at 403 NASA Rd. 1, and interested parties should call 486-0791 for more information.

BAPCO to meet September 16

BAPCO, the Bay Area PC Organization, will hold its next monthly meeting at 7:30 p.m., Tuesday, Sept. 16 at the Holiday Inn on NASA Rd. One. BAPCO is a microcomputer users group whose members share a common interest in IBM-PCs and compatibles. Its primary purpose is one of exchanging information and help to one another by means of monthly meetings, the formation of special interest groups, and distribution of a monthly newsletter. For additional information, call Earl Rubenstein at x3501, or Jack Calvin at 326-2983.

Two more NETs formed

Two new JSC/contractor quality circle teams whose initial aim is to improve communications have been formed. The new teams, in the areas of Public Affairs and Flight Equipment Processing, bring the number of NASA Employee Teams (NETs) to 19. Over 250 contractor and NASA personnel serve on these 19 teams, and 24 projects aimed at increasing workplace efficiency and safety have been approved.

"We wanted to start with a solvable problem of concern to all team members, so we began by discussing ways of improving communications between NASA and Boeing," Burl Kirkland, leader of the Flight Equipment Processing NET, said. Boeing is responsible for flight articles, ranging from tools and cameras to the mid-deck lockers and EMUs used by astronauts.

Kirkland said their NET found that they could improve communications regarding requirements that NASA gave to Boeing. Although an action desk already existed at Boeing to handle the processing of new requirements, Kirkland said

the desk was improved so that NASA employees could keep track of the status of a requirement. The action desk now also notifies NASA when a requirement is met.

Kirkland said their NET is comprised of NASA and Boeing employees, and the 12 members represent different areas like contracts, logistics and quality assurance.

Janet Ross, leader of the Public Affairs NET, also said their team is looking to improve the communication between the two sides of Public Affairs, media services and public services, and between their two contractors. Ross said the new team members have met weekly for over a month and are trying to improve the job they do.

"We're not looking for a problem to solve. If there was a problem, a manager would take care of it. But we are trying to brainstorm to find ways to improve communications. For example, we're trying to improve coordination between Omniplan personnel who give tours in Building 9A and the NASA personnel who send newpeople over there for shots," Ross said.

The 24 approved NET projects include the development of a new purchase order form and the simplification for small purchase awards. The civil service buyers and contract specialist NET estimates an annual savings of \$80,000 will be realized due to use of a new purchase order form and a laminated overlay method for confirming small purchase orders. The savings result from a 50 percent reduction in typing support, labor and materials.

Even apparently simple projects can yield significant savings. Construction drawings for project engineers are now rolled instead of being folded. This will save over 160 manhours annually. Other NET projects include increasing the accessibility of procurement forms and developing a five-day training program for new secretaries.

Teams also attempt to increase workplace safety as well as efficiency. One such project is aimed at replacing hazardous materials in shop areas with non-hazardous materials.

New commercial policy charted

(Continued from page 1)

As for launches of commercial satellites, NASA said it has 44 contracts, but could probably only launch 15 between now and 1992, when the new Orbiter comes on line. "We don't want to cancel the contracts outright," Fletcher said. He indicated that a new Shuttle manifest, due out soon, would prioritize those 44 payloads.

"We will let the companies know

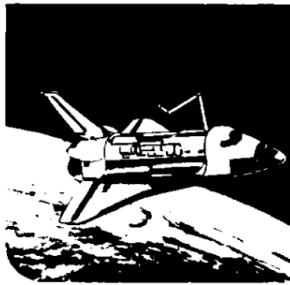
when they could fly," explained Rear Admiral Richard H. Truly, Associate Administrator for Space Flight. "If they want out of their contract, they can get out of it." Other payloads, designed specifically for Shuttle launch, probably would eventually be sent into orbit aboard a Shuttle.

"The private sector, with its ingenuity and cost effectiveness, will be playing an increasingly

important role in the American space effort," the Presidential statement said. "Free enterprise corporations will become a highly competitive method of launching commercial satellites and doing those things which do not require a manned presence in space. These private firms are essential in clearing away the backlog that has built up during this time when our Shuttles are being modified."

NASA
Lyndon B. Johnson Space Center

Space News Roundup



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Editor: Brian Welch

Tailor made

New zero-prebreathe suit isn't quite off the rack

By
David Luhman

Two items which often drive the design of space hardware—safety and cost effectiveness—are driving work at JSC to develop a new spacesuit for use on board the Space Station.

Conservative estimates indicate that there will be more EVAs on board the Space Station than is presently the case on the Space Shuttle. According to Mike Rouen of the Crew Systems and Thermal Division, this estimate was part of an early cost trade-off study to determine whether a new spacesuit was required for the Station. Rouen said that for the extensive EVA expected for such things as payloads and station maintenance, "It makes a lot of sense to develop a new spacesuit."

The suit being developed is a zero-prebreathe suit. Presently, astronauts aboard the Shuttle must go through a time consuming pre-breathe session to remove nitrogen from their bodies before undertaking EVA. The prebreathe session requires either having the EVA crewman breathe 100 percent oxygen for up to four hours prior to an EVA, or decreasing the Shuttle's cabin pressure to 10.2 psi for approximately 12 hours, and then breathe pure oxygen for 40 minutes. Either procedure is time consuming and interrupts other activities and experiments on the Shuttle. Just as importantly, the prebreathe session reduces the ability of the crew to respond to emergencies which require contingency EVA. Rouen said since the EVAs expected for the Station will be greater than those currently undertaken aboard the Shuttle, the inconvenience and cost associated with prebreathing is multiplied many fold.

"We expect up to 1,000 hours of EVA each year per suit once the Space Station is permanently manned. Since the prebreathe session uses up time on orbit — and the costs associated with an hour on orbit are mind boggling — it makes a lot of sense in the long run to develop a new suit which doesn't require prebreathing," Rouen said.

The cost trade-off studies undertaken by Rouen and his colleagues lead to the conclusion that zero-prebreathe suit (ZPS) is needed in the long run, but Rouen said the new suit will be phased into operation. He said any EVA required for initial Station construction will use present Shuttle suits, but he hopes a ZPS will be available for the Station when it becomes permanently manned. An alternate plan would use Shuttle suits for the first four to five years of operation of the Station.

Rouen said the development schedule of a ZPS is more flexible since it will only take some four years to develop, and it only takes 18 months to two years to make hardware components for the suit. An experimental ZPS being tested now prepares the flexibility in scheduling. The experimental suit demonstrates technology to support the final Space Station readiness schedule. Rouen said the Station Phase B contractors are also exploring new suit technology, with Rockwell subcontracting the work to Grumman, and McDonnell Douglas using Lockheed as a subcontractor.

The ZPS does not require pre-breathing because it operates at a higher pressure and thus allows astronauts to move immediately into EVA without having to face decompression sickness. Decompression sickness, otherwise known as caisson disease or "the bends," arises when the body is exposed to a rapid or drastic change in pressure. Body tissues

contain dissolved gases, principally nitrogen, in equilibrium with ambient pressures. When the outside pressure is dropped, nitrogen bubbles form in body tissues. If the pressure drops slowly in small increments, the bubbles are carried away by the blood to the lungs. If the pressure reduction is rapid or extensive, the gas bubbles become trapped in the body's tissues, giving rise to "the bends."

By operating at 8 psi, instead of the 4.3 psi at which the Shuttle suit operates, the pressure drop from 14.7 psi is not great enough to lead to decompression sickness. The higher suit pressures do impose some problems, however. For one, the suit must be more sturdy and must be carefully designed so it is not more difficult to move in.

"It's like bending a balloon, the more air in the balloon, the more difficult it is to flex it. But if you place rubber bands around the balloon, it's easier to flex," Joe Kosmo, also of the Crew and Thermal Systems Division, said. He added that one key aspect of the ZPS technology demonstrator suit is to find which joints are tough enough to withstand the higher operating pressures but don't excessively constrain the astronaut's motion.

Kosmo said a number of joints, ranging from toroidal convolute elbows to rolling convolute shoulders, have been developed to cope with this problem. He explained that these joints, which contain both fabric and metal rings, maintain flexibility because they maintain a constant volume of gas in the suit. As the top of a suit's joint is compressed, the joint is constructed so that the bottom expands. If the bottom did not expand, the pressure in the suit would increase, making further movement difficult. Kosmo said that one key technology for the ZPS is to develop a glove that will both handle the 8 psi pressure and still provide the flexibility and touch-sensitiveness that astronauts need.

Since the ZPS needs to be more sturdily constructed, it will probably weigh 50 pounds more than the Shuttle suit. The hard and semi-hard ZPS components will also occupy more volume than present Shuttle suits. These two factors will impose launch and storage constraints on the suit, but Kosmo believes these constraints will be more than compensated by the fact that individual joints, instead of entire arms or legs, may be replaced or stored in small areas. "These benefits should more than offset the initial individual weight and storage volume penalties," Kosmo said.

The technology demonstration phase of the ZPS is progressing well, and several different types of joints have been developed. The ZPS test suit developed uses a mixture of past, present and future technology as new arms and legs are tested on a Shuttle upper torso shell. These suit joints were developed using Apollo technology developed when NASA investigated a higher pressure suit for more lengthy stays on the lunar surface.

The job now facing Kosmo and others working on the suit is to determine which configuration of the ZPS is best. The final suit should allow freedom of motion with a minimum of effort. A number of tests are being conducted by co-operative education students to ensure this. One test used light emitting diodes placed on various locations of the suit, like the elbows, and cameras in a darkened room to measure the reach envelope afforded by different joint designs. Another test used a medical device used for

treating those with hand and upper arm disabilities. The device measures the torque and power a person applies to perform certain tasks. Finally, another device measures how the torque applied to a glove or joint varies with the angle of extension. "We want to develop a quantitative way to determine which joints and gloves are best," said Mariann Farquhar, a co-op student working on the ZPS study. The information gained from such a study will be used by more than the developers of the ZPS, "We expect satellite makers will use the data so that they won't make satellites which can't be worked on by astronauts," Kosmo said.

To perform these tests the suit has been pressurized up to 8 psi above the surrounding air pressure. Kosmo said they expect to have a suit ready for testing in the Weightless Environment Test Facility (WETF) by late 1987, and a suit rated for a pressure chamber will be available after that.

So a new suit is needed to handle the higher pressures associated with a ZPS, and a new life support system (LSS) is needed to meet Space Station requirements as well. Rouen said the new suit will operate autonomously, although an umbilical may be used for EVA-intensive activities like satellite servicing. "The life support system for a suit is patterned after the space vehicle's characteristics. For example, on the Shuttle the fuel cells produce water, so we use this water to cool the astronaut by venting the water into space. But we don't want to have a cloud of steam around the Space Station, so we're looking into using either ice or wax for cooling on the new suit," Rouen said.

Rouen explained that blocks of ice or wax would be formed on the Station and then placed in a portable life support system. Water would then be circulated around the block to cool the astronaut. Rouen added that the system needed the flexibility to heat the astronaut because, "We've found that when an astronaut gets out of the Shuttle's payload bay, he often gets too cool, and we need to account for this in the new suit."

The LSS must also provide the astronaut with oxygen and filter out trace gases. While the present Shuttle suit uses lithium hydroxide to filter out carbon dioxide, Rouen said they are looking into a solid amine and liquid absorbent system for the ZPS. Two requirements for the Station suit, that the suit's LSS be regenerable and servicable on orbit, are driving investigations into this area. To integrate the LSS with the ZPS, Rouen said they are investigating ways to provide a heads-up display with information from the LSS to the astronaut. With this, the astronaut can look up into his visor to check the status of his LSS instead of looking down at his chest as on the present Shuttle suit.

Finally, after an EVA, the suit will need servicing. This poses a unique challenge, and Rouen said the servicing area needed on the Space Station to service and check out the suit may be as difficult to build as the suit's LSS. Rouen said this will be a vital part of the new suit's system because present Shuttle suits are only rated to operate 21 hours before on-the-ground servicing. Although Rouen said this number is expected to double soon, it doesn't approach the 1,000 hours expected before on-the-ground servicing required for the Space Station. But this just once again leads to the conclusion that for the extensive EVA eventually planned for the permanently manned Space Station, a new space suit system must be developed.



Co-operative education student Phil West tests out shoulder and elbow joints for a proposed new space suit. The 200-pound suit is supported by a beam above West. Below, co-operative education students Marian Farquhar and West test out various shoulder and elbow joints for the suit.



Roundup Swap Shop

All Swap Shop ads must be submitted on a JSC Form 1452. The forms may be obtained from the Forms Office. Deadline for submitting ads is 5 p.m. the first Wednesday after the date of publication. Send ads to Roundup, AP3, or deliver them to the Newsroom, Bldg. 2 Annex, Room 147. No phone in ads will be taken.

Property & Rentals

Lease: Baywind II condo, large 1 bedrm, fpl., W/D connections, clubhouse w/exercise and party rooms, tennis, swimming pools, 1 blk from NASA/Clear Lake City gate, \$325/mo. 333-4144.

Lease: University Green patio home, 2-2-2, split bedrm design, 2 oversize garden baths, ex. cond., detached garage, cathedral ceiling, fpl., microwave, drapes, close to pool, \$595/mo. 488-0500 or 480-6516.

Lease: Univ. Trace townhome, 2-2-5-2 CP, all appliances, security sys., sauna, gym, \$500/mo. 333-4044.

Lease: Beach house, west Galveston Island, 3-2, AC, furnished, day/wk/mo. rates. Ed Shumliak, x6575 or 482-7723.

Sale: Friendswood/Forest Bend townhouse, 3-2.5, LR, den, lots of storage space, park, pool, \$49,000. 333-2322.

Lease: Separate garage apartment, 4 rm, fenced yard, pets OK, near League City Elem., furn. or unfurn., AC, \$275/mo. 554-5937.

Sale: Forest Bend, beautiful 4-2-2, fpl., fenced yard, separate game room, new AC, low taxes, Clear Lake schools, \$59,000. Glen, x6541 or 486-0462.

Sale: Forest Bend 2 br. townhouse, ex. cond., quiet area w/good neighbors, sacrifice price \$33,000 w/\$1,000 down. Glen, x6541 or 486-0462.

Lease: Baywind II condo, 1-1, fpl., all appliances, game room, tennis. Jim Wiltz, x5437 or 944-0451.

Lease: El Dorado Trace 1-1-1, W/D, fpl., sec. alarm, pools, clubhouse privileges including whirlpool, dry sauna, weight machine, \$350/mo. Alan, 282-3968 or 334-7814.

Lease: 2 bedroom bay house on Todville Road in Seabrook, view of Galveston Bay, \$450/mo. Cleave, x2221.

Sale: Baywind II 1-1 condo w/fpl., mirrored walls, mini-blinds, ceiling fans, W/D connections, assumable loan. 471-6814.

Clear Lake condo, 1-1-1, fpl., full size W/D, near pool & tennis courts at El Dorado Trace. \$325/mo. Mark, 280-6839.

Lease: University Trace condo, 1-1, study, W/D, fire & burglar alarms, 3 ceiling fans, convenient w/ex. facilities, \$350/mo. plus dep. 480-6771.

Lease/Sale: Medical Center 2-2 condo, perfect for students, security, W/D, refrig., pool, very nice, \$600/mo. Herman, x6316 or 488-1259.

Sale: Residential lot in Green Acres off NASA Rd. 1, \$10,000 cash. 324-4946.

Lease: Lake Livingston waterfront house, 3-2, sleeps 6, fully furnished, pier, ex. fishing, skiing, swimming, weekend & weekly rates. 482-1582.

Sale: Spacious Alvin home, 3-2-2 w/formal dining, study, fpl., near schools, college, shopping, \$55,000 or assume 9%. Kaye, x5222 or 585-3570.

Sale: 4-3-2 home in Friendswood on quiet cul-de-sac, oversized lot, never flooded, \$59,000. J. A. Trim, x3041 or 996-1655.

Sale: Horseshoe Lake Estates, Romayor, TX, Hwy 105 between Cleveland and Rye, 3-1, AC, furnished, 1 acre, fishing lake, Trinity River. S. Peterson, x3138 or 479-5594.

Lease: Baywind I condo, 2-2-2, new carpet, freshly painted, W/D, fpl., extra nice, \$425/mo. Cindy, x3289 or 538-1878.

Lease: Month-to-month 2-2 condo, fully furnished and equipped in Clear Lake City. 486-0819.

Sale: Mobile home, 80'x14', fenced yard, corner lot, screened patio, 3-2, fpl., wet bar, balcony kitchen, \$17,500. Eve, 559-2925.

Lease/Sale: Pipers Meadow, beautiful 3-2-2, contemporary, split floor, fpl., garden bath, ceiling fans, mini-blinds, fenced, near pool, \$675/mo. Linda, x3421 or 480-1967.

Lease: University Place Townhome, 3-2.5-1, W/D, refrig., microwave, fpl., avail., now, \$700/mo. David, x4716 or 488-9768.

Sale: '75 mobile home, 14'x60', new AC & heat, refrig., W/D connections, good cond., \$6,000 OBO. Lisa, 488-3720 or 991-0905.

Sale: Ranch, 101 acres, equipped, buildings, tanks, fruit trees, \$700/acre. 488-8105.

Sale: Easily 23% below mkt., own our roomy 2-2 Baybrook condo for only the modest amount owed. Marty, 486-0819.

Lease: Baywind II condo, 2-2-2, fpl., W/D, all appliances, ex. cond., \$375/mo. John McLeaish, 333-1882 or 480-7445.

Cars & Trucks

'74 Camero, 4 spd, rebuilt 305 w/30,000 mi., runs well, new tires, clutch, \$550. Rainey, x7272, 358-6612 or 474-2988.

'74 Toyota SR5 Corolla for parts, runs, needs body work, \$100 OBO. Scott, 474-2970.

'81 Buick La Sabre Limited, loaded, ex. cond., \$7,400. 996-1621.

'83 Fairmont Futura, silver w/red interior, 4 dr., auto, AC, AM/FM, nice car. 485-6074.

'84 Nissan Stanza, 4 dr, ex. cond., loaded, AC, low miles, \$6,500. Richard, x5933 or 482-8695.

'84 Fiero, black, loaded, heat crack on pass. side of windshield, 35,000 miles, ex. running cond. Hank, x3101.

'73 Dodge Maxivan, 360 V8, PS, AC, radio, \$400. Rodney, x4393 or 480-1340.

'69 Volkswagen Campmobile, ex. mech. cond., recent inspection, \$1,850 OBO. Steve, x5111 or 480-9715.

'79 Rabbit, runs well, orig. owner, \$1,200. Campbell, x2691 or 488-6494.

'83 Toyota Corolla, 2 dr, white, clean, automatic w/overdrive, AC, stereo, PS, good tires, \$4,900. Briggs, x5165 or 333-2717.

'79 Pontiac Sunbird, 4 spd, 55,000 mi., AC, AM/FM, very good cond., \$1,600 OBO. Richard, x6226.

'77 Gran Prix, mech. sound, new tires & shocks, a few dents but good buy for \$700. 280-9811.

'74 Mercedes 240-D, light-blue exterior, ivory interior, immaculate, 4 spd manual, runs perfectly, 25 mpg, orig. owner, \$4,995 firm. 482-7318.

'76 Fiat X 1/9, 4 spd, AM/FM/cass., Appliance mags, blue, good cond., \$1,580 OBO. Ken, x4778 or 534-2634.

'76 Plymouth Fury, 381 cu. in., 2 bbl., rebuilt tran., 4 dr., very good mech., some body rust, \$500. Gene Schmidt, x2576 or 474-4289.

'76 Plymouth Valiant, for parts, good 225/6 motor and 3 spd manual tran., \$300. Ruth, x4757 or 480-4553.

'73 Ford Gran Torino, S/W, PS, AC, runs, front end damaged, needs work, \$225. Alex, x6373.

'77 Firebird Formula, loaded, T-top, engine needs work, \$895; '76 Ford Mustang, loaded, \$1,495; '73 MGB, hard top & soft top, \$2,495. 337-1160.

RVs

Shasta travel trailer, 22 ft., sleeps 8, self contained, roof air, new tires, awning, ex. cond., \$3,950. 481-8885.

'84 Couchman travel trailer, awning, AC, stereo, many extras, \$9,800. Jerry Riley, 784-6338.

Boats & Planes

'67 model Boston Whaler, 13'7", Evinrude outboard, galvanized sportsman Big Wheel trailer, good fishing rig, \$1,500. Plauche, x6171.

Catamaran NACRA 5.2 sailboat w/trailer, \$1,500. Rodney, x4393 or Walt, x3481.

'71 16' Larson tri-hull w/'78 115 hp. Evinrude, trailer, great shape, must see, \$2,900. Joleen, 282-3054 or 280-8555.

Ultralight plane w/3-axis controls, ROTEC, ralley-2B, \$1,250 OBO. Wayne, x6226 or 486-7141.

18' Catamaran, AMF Trac sailboat with trailer & extras, like new, \$3,850. 333-3056.

Cycles

Super Goose BMX bike, ex. cond., \$75. Don, x3066 or 488-0754.

Girl's 20" Schwinn bike, very good cond., \$25. 944-6457.

Woman's bicycle, 27" Raleigh, good cond., 3 spd, \$60. Jim, x3669 or 488-4459.

'77 Yamaha XS 750D, very good cond., runs well, orig. owner, \$625. Rich, x7280 or 480-0880.

20" Sears girl's bike, pink, good cond., \$50; 16" boy's bike, \$40. Manicha, x6414 or 280-9822.

Household

Almost new 5/8 ton 115 volt Sears high efficiency window AC, Sanyo under counter refrigerator. 482-3002.

Full size mattress and box springs, \$50. John, x3905 or 482-1501.

Moving, household items, furniture, appliances, garage sale, Sat. Aug. 23, 1006 W. Flamingo, Seabrook. E. Rainey, x7272, 358-6612 or 474-2988.

Moving sale, choice of 3 full size beds w/mattresses, \$25 to \$80; 7' brown plaid couch, \$75. Barry, x4524 or 996-7916.

Twin maple headboard, \$10. John, x3905 or 482-1501.

Sofa, chair & ottoman, color putty, wood trim, \$75; buffet w/hutch, \$85; dinette set w/4 chairs, swivel, \$90. 996-8567.

5 drawer dresser, ex. cond., \$50. Nelda, x5011.

15 gal. hot water heater, \$50; 15' formica counter top, \$50; 22x30 maple cutting boards, \$40 each; 8 wooden chairs, \$25 each. Ray, 554-2908.

Student desk w/chair, \$30. 944-6457.

2 couches, 2 end tables, 1 desk. 534-6252.

Portable manual typewriter, iron & ironing board, dresser, mattress & box springs, brass bedstead, wooden table, snorkling equip., bulletin board, desk light. Linda, x2411 or 480-3187.

5pc. dinette set-brass, wicker padded chairs - brass, wood table, ex. cond., \$250. Nelda, x5011.

Panasonic port. elec. dryer, olive green color, \$50; Sears 13" elec. weed-wacker, \$10. Manisha, x6414.

Queen sleeper sofa, cream/rust, E. Am., \$350; Sears lawn tractor, 11 hp., 36", 1 yr. old, \$800; 3/4 hp. air compressor w/tools, 4 mo. old, \$500. 482-0935.

Maple finished drop leaf table, six matching chairs, table pad, \$85. Sue, 486-5402.

Moving sale: dining table, 6 chairs and breakfast: 36 in. side-by-side refrig./freezer; dryer, 2 coffee tables and odd tables; credenza, couch, double bed. Chambers, 482-7920.

Audiovisual & Computers

Pioneer RT-707 reel-to-reel, auto-reverse, HI-FI, stereo tape deck, 7" reel, 15 new Maxell tapes, \$229. John Greer, x4171 or 538-2327.

Your own mobile telephone, operating range 134-174 MHz, battery pack/charger included, \$750 OBO. 486-1315 or 470-1936.

Reel to reel tape deck, 4 channel, Sansui 7000, ex. cond., \$200. Marty Linde, 488-9044.

'85 Wards 19" color TV, cable ready, remote control, \$250. 554-2959.

Slide projector w/preview feature and remote control, includes 18 slide trays and carrying case, \$65. Jim, x3669 or 488-4459.

52" TV, 6 mo. old, \$2,500; Sears VCR/power pack/video camera/tripod/lights, \$700; Apple McIntosh computer w/Imagewriter, \$2,000; 10 ft. satellite dish system, \$1,700. 482-0935.

25" Magnavox color TV, remote, swivel, \$250 OBO. 996-8567.

Wanted

Wanted: Broken air conditioners, free removal, have truck, will travel. Ike, x4920.

Wanted: One Skylab and one ALT lapel pin. Phil, x6261.

Wanted: Soprano saxophone. Ray, 554-2908.

Need a partner to share trip and expenses to Marble Falls, TX, to bring the granite for the monument, let us buy it direct and save. Mark, x6186.

Want to buy elec. trains. Don, x2449.

Lost & Found

Lady's ring, yellow gold, 7 diamonds, 4 diamonds larger than other 3, lost in Bldg. 10 Aug. 11. Betty, x5083.

Lost in JSC parking lot, old rose needlepoint chair cover, one of matched set, sentimental value. Mary, 474-3319.

Softball glove lost July 31 on mixed field 1. Fits C. Dailey well, x6369 or 486-0193.

Pets

Black & white Springer Spaniel, 1.5 yrs old, very lovable, playful, good potential hunter, great w/kids, \$50. Alan, 282-3968 or 334-7814.

Doberman puppy, 5 mo. old, blue, house trained, tail and dewclaws removed, wormed, shots, \$125. Horton, x4084.

Free puppies, mixed breed, lab retriever, 7 wks old. Don, x3066 or 488-0754.

Free registered female Brittany Spaniel, son has fallen in love w/another girl and no longer has time to care for her. Bob, 482-7835.

Musical Instruments

Violin, ex. cond., \$150. 280-9021.

Miscellaneous

O'Neil full length wet suit, XL w/booties, \$85. 332-4759.

6' pool table w/slate top, \$250. R. Senter, x4451 or 482-7835.

Motor, 225 slant 6 in good cond., tune-up parts, etc. included, \$250. Ruth, x4757 or 480-4553.

Transferable gold card membership to President and First lady health and racquetball club, membership expires Oct. '87, \$23.71/mo. Debbie, x5425.

Swing set w/2 swings, glider, slide, see-saw, galvanized, \$45; sand box, 5'x5', 4 corner seats, \$15; pink & purple tricycle, \$5. Charles, x6421 or 487-2202.

P15 new bias ply tire, \$20. Campbell, x2691 or 488-6494.

Astros tickets, season ticket holder has seats available for all remaining Astro home games, will sell at face value. 282-4076.

Two 10 gal. aquariums w/2 lighted hoods and stand, \$15. Kellie, 484-0463.

Sale: Rossignol skis, 175 cm, well cared for, no bindings, \$50 OBO;

Garmont Omnilit ski boots, women's 9, \$30 OBO. Karen, x3576 or 520-8348.

Regulation size pool table, auto return, accessories, \$310. Herb, 333-4822.

Men's wet suit, Parkway, heavy duty, x-large, \$50. Joan, x3057 or 486-1058.

Cross bow, just like new, used five times, \$100. Cindy, x3289 or 538-1878.

Cookin' in the Cafeteria

Week of August 25 — 29, 1986

Monday — Beef & Barley Soup; Beef Chop Suey, Breaded Veal Cutlet w/Cream Gravy, Grilled Ham Steak, Wieners w/Baked Beans (Special); Buttered Rice, Brussels Sprouts, Whipped Potatoes. Standard Daily Items: Roast Beef, Baked Ham, Fried Chicken, Fried Fish, Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday — Celery Soup; Fried Shrimp, Pork Chop w/Applesauce, Turkey a la King, Pepper Steak (Special); Au Gratin Potatoes, Breaded Squash, Buttered Spinach.

Wednesday — Seafood Gumbo; Fried Catfish w/Hush Puppies, Braised Beef Ribs, Mexican Dinner (Special); Spanish Rice, Ranch Beans, Buttered Peas.

Thursday — Green Split Pea Soup; Corned Beef w/Cabbage & New Potatoes, Chicken & Dumplings, Tamales w/Chili, Hamburger Steak w/Onion Gravy (Special); Navy Beans, Buttered Cabbage, Green Beans.

Friday — Seafood Gumbo; Deviled Crabs, Broiled Halibut, Liver & Onions, BBQ Link (Special); Buttered Corn, Green Beans, New Potatoes.

Week of September 1 — 5, 1986

Monday — Labor Day Holiday

Tuesday — Split Pea Soup; Meatballs & Spaghetti, Liver & Onions, Baked Ham w/Sauce, Corned Beef Hash (Special); Buttered Cabbage, Cream Style Corn, Whipped Potatoes.

Wednesday — Seafood Gumbo; Cheese Enchiladas, Roast Pork w/Dressing, BBQ Link (Special); Pinto Beans, Spanish Rice, Turnip Greens.

Thursday — Beef & Barley Soup; Roast Beef w/Dressing, Fried Perch, Chopped Sirloin, Chicken Fried Steak (Special); Whipped Potatoes, Peas & Carrots, Buttered Squash.

Friday — Seafood Gumbo; Fried Shrimp, Baked Fish, Beef Stroganoff, Fried Chicken (Special); Okra & Tomatoes, Buttered Broccoli, Carrots in Cream Sauce.

Week of September 8 — 12, 1986

Monday — Cream of Potato Soup; Franks & Sauerkraut, Pork Chop, Potato Baked Chicken, Meat Sauce & Spaghetti (Special); French Beans, Buttered Squash, Buttered Beans. Standard Daily Items: Roast Beef, Baked Ham, Fried Chicken, Fried Fish, Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday — Navy Bean Soup; Beef Stew, Liver & Onions, Shrimp Creole, Smothered Steak w/Dressing (Special); Corn, Rice, Cabbage, Peas.

Wednesday — Seafood Gumbo; Roast Beef, Baked Perch, Chicken Pan Pie, Salmon Croquette (Special); Mustard Greens, Italian Green Beans, Sliced Beets.

Thursday — Beef & Barley Soup; Beef Tacos, Diced Ham w/Lima Beans, Stuffed Cabbage (Special); Ranch Style Beans, Brussels Sprouts, Cream Style Corn.

Friday — Seafood Gumbo; Fried Shrimp, Deviled Crabs, Ham Steak, Salisbury Steak (Special); Buttered Carrots, Green Beans, June Peas.

AT BUILDING #3

On Wednesday we feature The Reuben: Corned Brisket, Swiss Cheese on a bed of Sauerkraut, Poupon Mustard on Rye and 1/4 Pickle. Delicious!

Monday and Thursday check out our French Dip Sandwich.

Gilruth Center News

Call x3594 for more information

Ladies weight training — This popular course begins Sept. 8 and runs for 4 weeks. The class meets Mondays and Wednesdays from 7 to 8 p.m. The cost is \$20 per person.

Defensive driving — Learn to drive safely and qualify for a 10% reduction in your auto insurance for the next three years. This all day Saturday class meets from 8 a.m. to 5 p.m. Sept. 20. Space is limited.

Jazzercise — Designed to develop total fitness, this four-week class meets Mondays and Wednesdays from 4:30 to 5:20 p.m. beginning Sept. 3. The cost is \$20 per person.

Tennis lessons — Beginning and intermediate tennis classes are scheduled to start Sept. 8 and Sept. 10, respectively, at the Rec Center. The 8-week sessions run from 5:15 to 6:45 p.m. and cost \$30 per person.

Exercise class — Come stretch with the gang and feel physically fit. This 4-week class begins Sept. 8 and meets Mondays and Wednesdays from 5:30 to 6:30 p.m. The cost is \$12 per person.

Exercise and relaxation — This class teaches students how to use exercise to gain inner peace, awareness and control of their bodies. The class begins Aug. 26 and meets for 6 weeks. Class times are 7 to 8:30 p.m. and the cost is \$28 per person.

Ballroom dance — This class teaches the basics of such steps as the rumba, foxtrot, cha cha and waltz. Beginners will dance from 8:15 to 9:30, intermediates from 8:15 to 9:30 and advanced from 7 to 8:15 p.m. The course begins Oct. 2, runs for 8 weeks and costs \$60 per couple. No individual registration is allowed.

Notice to Retirees

Retired JSC employees who receive the *Space News Roundup* should contact the Personnel Office, not the Roundup office, for change of address notification. Send change of address information to Personnel Office, Mail Code AH76, NASA Johnson Space Center, Houston, TX 77058. Please allow 60 days for processing.